Space Weather Forecast

Issued on Monday, 23 January 2023 at 12:39 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Reducing risk of R1/R2 Radio Blackouts and G1/Minor Geomagnetic Storms after midweek (UTC).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been moderate during the past 24 hours, with two Moderate-class flares observed: the largest at 22/1701UTC from the Sun's southwest, preceded by a longer period event at 22/1227UTC from the largest sunspot.

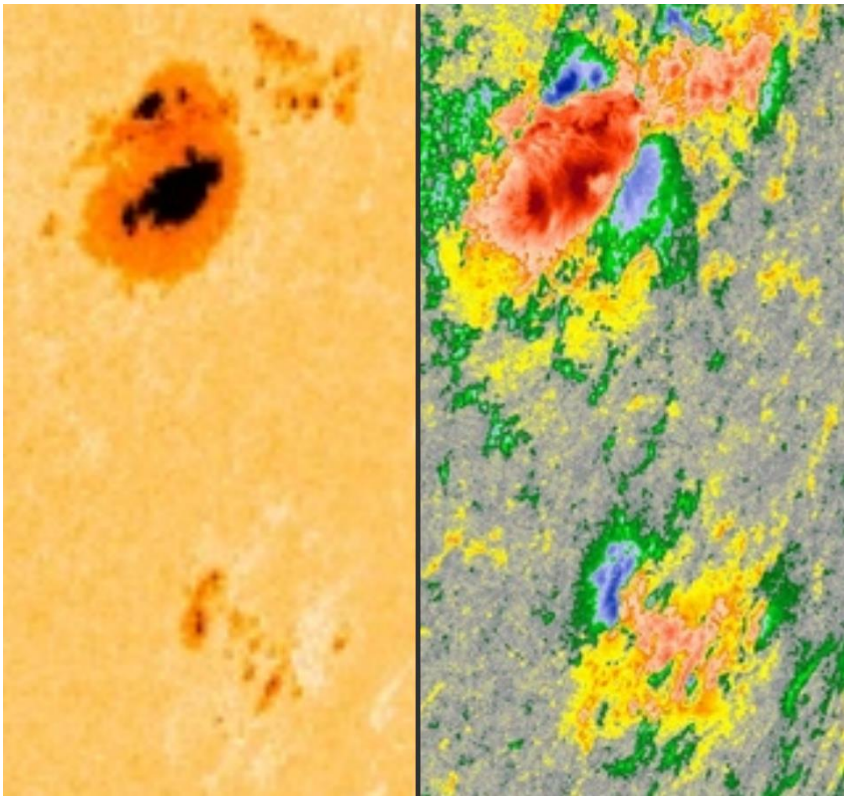

Figure 1: Visible and false-colour magnetic imagery as at 23/1100UTC showing the two most active sunspot regions of the past 24 hours.

There are currently nine sunspot regions on the Sun, possibly now joined by a new region in the northeast. The northern solar hemisphere is currently the preserve of numerous diffuse magnetically bipolar regions, with those in the east generally non-productive in terms of flares in the past 24 hours, however those in the west did display some UTC evening (common-class) flare activity.

The southern solar hemisphere has its efforts concentrated in the southwest by contrast, with

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the two most-changed groups occupying this sector, producing the peak flares of the period.

There are currently numerous 'filaments' (arcs of plasma) on the Sun, with most of these concentrated near the western solar horizon in both hemispheres, which is of note as they could be triggered by the more active sunspots here should they flare appropriately. Satellite imagery in the period showed numerous small Coronal Mass Ejections (CMEs) emerging from the west and southwest - at the time of writing none of these have been assessed as having an Earth-directed component. After 23/0500UTC, a southeast-directed CME appeared, which is currently thought to be far-sided and off the Sun-Earth line but will be assessed in due course. No new Earth-directed CMEs were therefore in evidence at the time of writing.

Solar Wind / Geomagnetic Activity: Solar winds speeds showed a relatively noisy trace within Slightly Elevated to Elevated levels, rising by the period's end. These were suggestive of an initial waning fast wind from a 'coronal hole', which then saw a small discontinuity at 23/0300UTC which may suggest influence of one of the expected CMEs, perhaps most likely that from 19 January.

The number of particles in the solar wind rose to become slightly elevated over the same period. The magnetic field associated with these particles showed the most noteworthy behaviour in the 24 hours, with a 23/0300UTC discontinuity most marked here, rising from Background to Slightly Elevated levels, while the north-south component varied between similar levels, albeit mainly co-aligned with the Earth's field to limit geomagnetic impacts (thus far).

The net effect of the above solar wind measures was mostly quiet, well below Minor Geomagnetic Storm G1.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain moderate, with the most potent regions in the southwest. These should rotate off the disc after midweek UTC to slightly reduce the daily chances of Moderate class X-ray activity.

Solar Wind / Geomagnetic Activity: The geomagnetic forecast is of lower than average confidence for the period: both due to marginal influence of a number of CMEs before midweek, and also a newly-developed coronal hole fast wind. Initial likely Minor Storm G1 conditions should become less prevalent as the week progresses (barring significant developments), especially as the filaments and more-active southwestern sunspots rotate away from the Sun-Earth line.

Energetic Particles / Solar Radiation: Solar radiation storms have a Slight Chance of reaching S1 or greater through the period given the presence of the larger and more active sunspot regions near the better connecting western solar horizon (should they flare appropriately).

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	50	40	20	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	60	60	60	50
Very Active	R3 to R5 X	No	5	5	5	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	15	15	15	15
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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